Maximal power output typically occurs when subjects perform ballistic exercises using loads of ~30% of one-repetition maximum (1-RM). However, performing 1-RM testing prior to power measurement requires considerable time, especially when testing involves multiple exercises. Maximal isometric force (MIF), which requires substantially less time to measure than 1-RM, might be an acceptable alternative for determining the optimal load for power testing. PURPOSE: To determine the optimal load based on MIF for maximizing dynamic power output during leg press and bench press exercises. METHODS: Twenty healthy volunteers (12 men and 8 women; mean ± SD age: 31 ± 6 years; body mass: 72 ± 15 kg) performed maximal isometric leg press and bench press movements, during which MIF was measured using force plates. Subsequently, subjects performed ballistic leg press and bench press exercises using loads corresponding to 20%, 30%, 40%, 50%, and 60% of MIF, in randomized order. Maximal instantaneous power was calculated during the ballistic exercises using force plates and position transducers. Repeated-measures ANOVA and Fisher LSD post-hoc tests were used to determine the load(s) that elicited maximal power output. RESULTS: For the leg press power test, 6 subjects were unable to be tested at 20% MIF because these loads were less than the lightest possible load (i.e., the weight of the unloaded leg press sled assembly; 31.4 kg). For the bench press power test, 5 subjects were unable to be tested at 20% MIF because these loads were less than the weight of the unloaded aluminum bar (i.e., 11.4 kg). Therefore, these loads were excluded from analysis. A trend (P=0.07) for a main effect of load existed for the leg press exercise, indicating that the 40% MIF load tended to elicit greater power output than the 60% MIF load (effect size = 0.38). A significant (p < 0.05) main effect of load existed for the bench press exercise; post hoc analysis indicated that the effect of load on power output was: 30% > 40% > 50% = 60%. CONCLUSION: Loads of 40% and 30% of MIF elicit maximal power output during dynamic leg press and bench presses, respectively. These findings are similar to those observed when loading is based on 1-RM.

Conclusions

Maximal isometric force (MIF), which requires little time and is inherently safe to perform, can be used as an alternative strength measure for determining the optimal load for power testing. Loads of 40% and 30% of MIF elicit maximal power output during ballistic, concentric-only leg presses and bench presses, respectively. The optimal relative load for measuring peak power output (i.e., ~30-40% MIF) is similar to that which is recommended when loading is based on 1-RM (i.e., ~30-1-RM).

References


Acknowledgements

This work was supported by the National Aeronautics and Space Administration. We would like to thank Kirk English, Mark Leach, and Leah Stroud for invaluable assistance during data collection and an enthusiastic group of volunteers for participation in the study. Results of the present study do not constitute endorsement by ACSM.